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POTATO SPRAYING AND POTATO SCAB

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In connection with a study of the effect of bordeaux mixture on foliage and tuber development during 1933 at Pittsford, N. Y., it was found that sprayed plants yielded a higher percentage of tubers free from scab than did unsprayed plants. Observations were made at intervals during the season, when plants under various treatments were dug in order to study the effect of different amounts of copper sulfate in the form of bordeaux mixture on foliage and tuber development.

The first scab lesions were observed September 16. While the number of scabby tubers was not determined for this date, the percentages for subsequent observations were recorded and are given in table 1. For September 29 and October 16, each figure represents the percentage of scabby tubers found for a total of forty plants. The figures for October 30 are average percentages of four samples, each of which consisted of from 240 to 280 tubers. Appended to table 1 is the analysis of variance for the data which shows that the differences are highly significant.

It will be noticed that the percentage of scabby tubers in the lots from unsprayed plants is higher than in the samples of any of the sprayed plants, and that with increasing amounts of copper sulfate applied, the percentage of scabby tubers drops. Practically no difference, however, occurred when more than 48 pounds of copper sulfate to the acre were applied during the season. In addition to this, the percentage of scabby tubers decreased with the advance of the season. This was found for all the lots, from both sprayed and unsprayed plants.

Regarding soil moisture conditions under which these experiments were conducted, it may be stated that the moisture content was high in July, decreased during August, became moderately low in the forepart of September, and increased thereafter through the remainder of the season.

In addition to the records given in table 1, observations were made in 1933 on the tubers obtained from plants in other spraying experiments on the same farms. In all these cases the soil was alkaline (pH above 7.5) so that acidity could not have been a limiting factor. In field 2 the soil moisture was never low during the season and the soil was well supplied with organic matter. Here the unsprayed plots gave an average yield of 212.1 bushels per acre compared with 174.4 bushels for field 1. These results are given in table 1. Neither sprayed nor unsprayed plots in field 2 produced scabby potatoes. In a nearby field, number 3, the soil became moderately dry early in August and very dry for the remainder of the season, so that unsprayed plots yielded only 112.6 bushels per acre and practically all tubers, both from sprayed and unsprayed plots, showed scab lesions. Such differences in scab between fields obtained in the same season, may be due to differences in soil moisture and the organic matter content of the soil, as roughly indicated by the yields, but the rather marked differences between sprayed and unsprayed plots were unexpected and the cause is less obvious.

TABLE 1—*Percentages of scabby tubers and yields in the concentration spraying experiment. Pittsford, N. Y.* 1933.

Date of Sampling	Number of Counts	Amount of Copper Sulfate Applied in the Form of Bordeaux Mixture in Pounds per Acre During the Season						
		0.0	24.0	36.9	48.0	73.9	96.0	144.8
		Percentage of Scabby Tubers						
9/29	1	72.4	31.9	18.1	9.8	12.1	9.9	13.8
10/16	1	59.5	23.2	16.0	7.2	7.0	9.7	6.5
10/30	4	35.3	16.6	10.4	8.2	7.6	8.5	8.4
Averages		45.5	20.3	12.6	8.3	8.2	8.9	9.0
		Yields in Bushels per Acre. Average of 12 1/100 Acre Plots Each.						
		174.4	237.2	260.9	281.3	294.6	285.6	274.7

Analysis of variance of percentages of scabby tubers.

	Degrees of Freedom	Sum of Squares	Variance	F†
Total	41	8405.0841		
Counts include different dates and replications	5	661.6784	132.3357	
Treatments	6	6710.1241	1118.3540	32.446‡
Error	30	1034.0385	34.4680	
Dates	2	656.3383	328.1629	9.52‡

† F of Snedecor's table (7) which equals treatment variance divided by error variance.

‡ Corresponds to odds greater than 100:1.

TABLE 2

Date of Sampling	Number of Experiment	Percentage of Scabby Tubers	
		Sprayed	Unsprayed
Oct. 17, 1934	A	7.8	27.0
Oct. 10, 1934	B	4.4	38.8

Similar results from spraying were obtained in the season of 1934 in two different fields (table 2). Samples consisting of 800 tubers were collected at random from both sprayed and unsprayed plots in each of these experiments. Counts were not made for the separate plots, so that it was not possible to compute the deviations and errors. However, it would be expected that counts of clean and scabby tubers would form a binomial distribution. From appropriate tables (2) it is estimated that differences of about 4.5 per cent for samples of this size would give odds of 50:1 that the samples came from different populations. As the differences obtained are much larger than this, there can be little doubt of their significance.

While it is not possible to explain with certainty these unexpected results, some observations have been made on the effects of spraying on the growth, development and chemical composition of potato plants,

which suggest ways in which such differences in the percentages of scab might be brought about. Plants receiving larger amounts of copper sulfate in the form of bordeaux mixture responded with an increase in their total foliage growth. (3, 6). The larger the amounts of copper sulfate applied, the greater the foliage weight. Also, accompanying this increase in foliage there was a delay in tuber enlargement. Thus, shortly after tuber setting, the individual weight per tuber was found to be largest in the untreated, and the weight decreased as the amounts of copper applied were increased. This relation of different individual tuber weights continued until the latter part of September; thereafter, due to an increased rate of tuber enlargement, especially in those treatments receiving large amounts of copper, practically no differences in the individual tuber weights in any of the plots were found. In addition to this, studies on tuber-setting revealed that although there was practically no difference in the number of tubers in any of the treatments, including the check, at the time the first counts were made, the number of tubers decreased with advance of season, regardless of treatment. The decrease was most marked in the untreated and those receiving small amounts of copper sulfate.

That infection must have taken place in the early part of the season, probably about the middle of August, is suggested by the fact that the percentage of scabby tubers decreased with the advance of the season. Since it was found that the total number of tubers also decreased with the advance of the season, it is possible that the infected tubers did not develop or were re-absorbed more readily than the healthy ones. Another possibility is that the tubers simply outgrew the scab as has been shown by other investigators (1). Since no millepede injury was found on any of these tubers, it is improbable that the decrease in the percentage of scab lesions was due to the activity of this arthropod in eating out the lesions.

Chemical analyses of tubers showed that the percentage of total nitrogen was highest in those from plants which received large amounts of copper (Mader, thesis). They revealed differences in the amounts of copper in the young tubers from 2.5 to 5.5 parts per million for the sprayed and from 2 to 2.5 parts per million for the unsprayed. These differences in amounts of copper were most marked in young tubers and analyses have shown that the larger part is in the outer layers of the cortex, but still the amounts are so small that tests are needed to determine what influence, if any, the copper may have.

Recently the work of Schaal (4) has shown that under some conditions flea-beetle larvae carry the scab organism and cause infection

of the potato tuber. Infected larvae tracks, as illustrated by Schaal, have not been commonly observed in New York, although the punctures made by larvae of this insect are fairly common. Whether such punctures have any relation to the occurrence of scab spots has not yet been determined. Further observations are also needed to determine whether control of the adult flea-beetles on the plants by spraying can have any considerable influence on the occurrence of the larvae of this insect and thus of scab on the tubers in the relatively narrow experimental plots.

Spraying with bordeaux mixture also effects the transpiration rate as shown by Wilson and Runnels (5). Under the rather dry conditions of the past few seasons, the plants in the sprayed plots have been observed to wilt more quickly than those in the unsprayed plots. This may result in a more rapid "hardening" of the plants and tubers, thus resulting in reduced scab susceptibility.

Similar results on the control of potato scab by spraying with bordeaux mixture were reported in early experiments (Kinney 1891, Weed 1889), when only a few applications were made by hand but these results have apparently been largely ignored though the data obtained in some of them seem to be fairly convincing.

Conclusions

For the past two years marked reduction in the percentages of potato scab have been obtained in certain fields by spraying potatoes with bordeaux mixture.

Several ways in which spraying might cause such results are suggested. The delay in tuber-setting and enlargement caused by spraying, might throw these phenomena into a period when higher soil moisture prevails, thus reducing the amount of infection. Tubers from sprayed plants have a higher total nitrogen and copper content, either of which may have some influence on infection. Reduction in the population of flea-beetles may reduce inoculation. Sprayed plants wilt more in hot weather and this may bring about changes which make the tubers more scab-resistant.

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THE POTATO FIELD TRIAL[1]

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The potato field trial is a means of evaluating the relative merits of two or more varieties, treatments, or practices. The conclusions and recommendations from any such experiment are materially strengthened if some statistical method has been used in the analysis of the data. Yet statistical analysis alone may well be of no greater value than observation alone. Either one of these methods of interpretation without the other may subject the investigator to justifiable criticism. It is well, then, to analyze and coordinate both statistical and observational data before recommending any radical change of practice.

It is the purpose of this paper to point out to the potato research workers some of the principles involved in the application of certain methods of statistical analysis which they may use to reduce the data and in particular to bring to their attention the "analysis of variance" method. The time to decide which method of analysis shall be used is before the experiment has been started. Too often the research worker conducts his experiment and then has to call for help in the analysis of the data. A little thought and foresight will often save considerable effort and may mean the salvaging of data that might otherwise have been discarded.

Many potato experiments are conducted on private farms rather than on experiment station grounds. The layout of such experiments must be modified somewhat to satisfy all parties concerned. The farmer naturally desires the least possible interference with his regular rotation and cultural practices; he much prefers that the experiment be laid out along a very few rows running the entire length of

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the field and does not like to have any treatment used that will result in a poor crop. If the county agent enters the picture he thinks of the experiment as a demonstration; naturally he prefers to have a systematic planting, across many rows at the edge of the field, and alongside a well-paved road. The scientist would prefer a block of soil in shape approaching a square, because of ease of handling, and observation of relative performance, and the greater possibility of obtaining uniform environmental conditions such as soil, light, air and water. Power equipment and spraying experiments may require longer rows than some others but the principle remains the same. These cross purposes and conflicting desires must be reconciled by compromise to the satisfaction of all concerned.

On the experiment station grounds, however, there should be little need for compromising. To be sure there are practical limitations of time, land, and money but these conditions can often be met by cutting down the number of things being tested. As a matter of fact, too often the investigator endeavors to answer too many questions with one experiment. Small experiments, personally conducted and properly analyzed statistically, accomplish much more in a given time than will more extensive trials involving many variables.

There is yet in the minds of many research workers the question as to whether checks are necessary. In answer it may be stated that checks do have a place in most field experiments. It should be pointed out at once that 'no treatment' plots used as checks have outlived their usefulness. At the present time there are but a few situations where the grower does not appreciate the advantage of using some fertilizer or some form of spraying or good seed stock. Any plots used as checks in present-day experiments should receive a basic treatment in line with accepted practices. Starting at that level the investigator may proceed to demonstrate the superiority of his particular theory.

Check plots distributed systematically throughout the experimental area provide one of the best indicators of the variability of the soil and weather. If it is practicable to have many check plots it becomes possible to approximate quite closely the unattainable goal of all investigators, namely, to grow two things on the same identical spot of ground. Check plots, in this connection sometimes spoken of as standards, provide an excellent yardstick by which to estimate the relative worth of the various treatments. Oftentimes observational data concerning the response of the plant day by day to the several treatments being considered are more useful than the statistical analysis in the final interpretation of the data.

Considering first the simple experiments involving only two vari-

ables perhaps it would be better to so plan the experimental layout as to be able to make use of Student's Method (1) (1a) of pairing. This method removes the correlation between variates, mathematically, resulting in a more valid estimate of the experimental error. Student's (2) more recent test for significance makes use of the ratio of the mean difference to its standard error and recognizes the validity of entering the table at 'n' equal to one less than the number of paired observations. This 't' test for significance is equally useful for the ratio of M/óM, whether such a ratio results from the application of Student's method of analysis or some other.

Tables of odds calculated from Student's probability values for argument 't' are to be found in the Journal of the American Society of Agronomy, Volume 26, Numbers 4 and 8 (3) (4). In fact the 't' test for significance should be used in the analysis of any experimental data when determining the mathematical significance of a difference, for it is equally available for small populations or large ones, and it is readily adapted to any argument, 'x/ó,' 'z,' or 't.' The odds in the modified Student's table for 't' used in their original form are to be interpreted as against a deviation in one direction being due to chance, but if the '2 times + 1' theory is applied then the odds may be interpreted as against a deviation in either direction being due to chance.

If pairing of the data cannot be accomplished by plot layout, then the usual method of analysis may be applied. Determine the mean of each treatment and its standard or probable error and then calculate the difference between any two means together with its error. The ratio of the difference to its error delimits a certain proportionate area of the curve of error from which value it is possible to determine the probability or odds against so great a difference being due to chance alone, or in other words to determine the mathematical significance of the difference between the two means. If the data have been derived from an experiment using either a few plots or treatments or a large number enter the table for 't' in the proper column and read the odds.

A paper of this sort would hardly be complete without some mention of the probable error. There has been much discussion pro and con in regard to the relative merits of the probable error and the standard error. Actually it makes no difference which error one uses provided his audience or reader knows which one he is using. The choice of type of error really becomes a personal matter. If it is easier for you to visualize that ± 1 PE divides the total curve of error exactly .50 to .50 and to grasp the significance of the fact that the

next similar mean difference has an even chance of being within the limits of ± 1 P. E., then use the probable error. On the other hand, if you can readily visualize that ± 1 ó divides the total curve of error in the proportion .68 to .32 and interpret that to mean that the next similar mean difference has a 2 to 1 chance of being within the limits of ± 1 ó, then use the standard error.

Practically all probability tables have been constructed for arguments based on the standard deviation yet it is possible to enter these tables with the probable error through the proper use of the factor .6745, for the constant ratio of the probable error to the standard error is as .6745 to 1. The standard error is the simpler calculation, for the standard deviation of any series of variates is the standard error of any one of those variates. The standard error of a mean is the quotient obtained by dividing the standard deviation by the square root of the number of variates averaged to obtain that mean, $óM = ó/\sqrt{n}$.

Data from more complex experiments, those involving three or more variables, might be analyzed by some one of the several forms of the generalized error method. Briefly, the generalized error method is based on the assumption that a better measure of relative performance may be obtained by using every plot in the experiment to determine a general error, expressed in per cent, equally applicable to all means, rather than to determine an individual error for each mean based on the relatively few plots of that particular strain or treatment. The earlier methods of this sort have for the most part been discarded or replaced by the analysis of variance.

It is not entirely clear as to whether Student, Sanders, or Fisher should get the credit for originating the 'analysis of variance' method. Be that as it may, R. A. Fisher (5) published the method in the first edition of his book, 'Statistical methods for research workers.' The method is referred to as Fisher's analysis of variance. Later simplification, of arithmetical procedure have been published by several men, the latest and most helpful is that by Snedecor (6).

The particular advantages of the analysis of variance method are that one may determine a generalized error for the entire experiment and at the same time apportion the total variance among the different sources of variance. In other words, that portion of the total variance which may be ascribed to experimental error is separated from the more important known sources of error.

The term 'variance' is a word used to describe the mean squared deviation; or that value, the square root of which becomes the standard deviation. Another advantage of using variance is that the sums of squares may be manipulated by addition, subtraction, and the like,

whereas standard deviations cannot be so treated. The additional contribution by Fisher is the concept of 'degrees of freedom' to replace 'n', the number of observations. Usually the degrees of freedom are one less than the number. For example, if six values have resulted in a given total then the degrees of freedom (DF) are 5, for any value may be assigned to five of these values but the sixth is determinate because of the fixed total. Similarly if eight totals together make up a grand total, then the degrees of freedom (DF) would be 7, for any value may be assigned to seven of the individual totals but the eighth is determinate because of the fixed value of the grand total.

To be specific, suppose an experiment were to be conducted to determine the need of manganese. The treatments are replicated five times in any one location and the entire experiment is repeated in six different locations. The variance of the five replications and the six fields as a result of the different levels of fertility and other environmental conditions that will be unlike in the several replicates or several fields, is removed. The remainder of the variance includes that due to treatment and that portion which may be ascribed to error. The ratio of the treatment variance to the remainder or error variance is used to determine the mathematical significance. The variance due to error is decidedly smaller by this method than any similar value derived by any of the earlier methods.

Do not be misled by the size of the error; the mere reduction of the magnitude of the error is not the purpose of the analysis of variance method. The important contribution of that method is that it enables one to obtain a more valid estimate of the error of the experiment. In other words, the analysis of variance method enables the investigator to separate the total variance of any experiment into its component parts and so determine with a high degree of exactness the particular cause or causes of an observed difference in performance of two or more treatments or varieties. Use of the analysis of variance enables one to determine which is the most important cause, whether it be varietal, environmental, seasonal, or error of random sampling.

After the several variances have been determined the 'F' test for significance, the ratio of one variance to another, as published in Snedecor (6), is the most convenient one available at the present time. The 'F' test is a modification of the 'z' test, avoiding the use of natural logarithms as originally proposed by Fisher (5).

Although it is true that complete randomization of unit plots or treatments is preferable in order to obtain the maximum benefit in the use of the analysis of variance, yet data from experiments in which the unit plots or treatments are to any degree or completely systematically

arranged may be subjected to the analysis of variance. As a matter of fact, a systematic layout is one of the possible random plans for any particular experiment. Neely (7) found that of several random plot arrangements and of many systematic plans no one layout was consistent when used in the analysis of data from two years' uniformity trials with field beans. In other words, in his experiment it was purely a matter of chance as to whether a systematic plan or a randomized plan resulted in the best estimate of the error of the experiment.

Assuming that the data have been analyzed and the probability determined, how shall the probability or odds be interpreted? If Student's table for 't' (2), or either modification (3) (4) of it, has been used the odds are to be interpreted as so many to one against so great a deviation in one direction only being due to chance, or only once in so many times would a difference less than zero be found in repetitions of that experiment. If Fisher's (5) 't' test or 'z' test is used, or Snedecor's (6) modification of those tests be used, then the odds are to be interpreted as so many to one against so great a deviation in either direction being due to chance, or only once in so many repetitions of that experiment would a difference, greater than or less than the limits which determined the odds, be obtained. It necessarily follows that the odds in the first instance shall be exactly '2 times + 1' greater than the odds in the second instance, for either of two possible events will occur by chance twice as frequently as will either one of them in particular.

In Fisher's (5) and Snedecor's (6) tables there are but two levels of significance, the 5 per cent and the 1 per cent. How are these to be interpreted? The 5 per cent and 1 per cent represent improbability values; subtracting from 1.0 recovers the probability values, .95 and .99 respectively. In the usual manner the odds would be .95/.05 and .99/01, or 19:1 and 99:1 respectively. Fisher has said odds of 19:1 shall indicate mathematical significance and 99:1 shall indicate greater significance or practically certainty. If the probability value from an experiment indicated odds of 18:1 should one say that the difference is not mathematically significant? Most certainly not, for these levels of 19:1 and 99:1 are purely arbitrary ones. Odds of 18:1 indicate a less significant difference than do odds of 19:1 or, 20:1 or 30:1, and odds of 18:1 imply a greater mathematical significance than do odds of 15:1. Each level of significance is more or less significant statistically than is any other level.

The level of significance represented by odds of 19:1 merely indicates that 95 per cent of the total curve of error has been included within the limits while 99:1 includes 99 per cent of the curve. It is for

each investigator to determine for himself how large a portion of the total curve must be included before he cares to state that the odds are sufficiently high to indicate mathematical significance. Probability values and odds of themselves are not significant, they are merely convenient labels with which to mark any one of the infinite degrees of significance between zero and one.

Another point to be considered is that of the choice of the form of odds that means most to the lay reader, in this case the farmer. Should the investigator use the probability of deviation in either direction or the probability that the deviation is greater than zero? Suppose an experiment in which the mean difference and its standard error are 4 ± 2, then 't' equals 2 and the odds are 19:1 against so great or a greater deviation in either direction and the probability is that 39 of the next 40 similar experiments would show a deviation greater than zero.

Does it mean more to the farmer to know that 39 times out of 40 the difference between the two means will be greater than zero or that 19 times out of 20 the difference will be between 0 and 8? From the standpoint of continuous crop production the latter statement is of much greater value. It may mean even more to know that 2 times out of 3 the difference will be between 2 and 6. The better farmer plants the same acreage year after year to any particular crop; he is interested in as nearly uniform production per acre as possible each year. Odds describing the limits within which he may expect the difference to fall are of more practical use to him than the probability that the next difference may fall between zero and some unknown upper limit. In other words, uniformity or consistency of performance is more important than occasional wide fluctuations no matter how favorable they might be.

The last point to be discussed relates to the question, are statistical measures of significance sufficient basis for the drawing of conclusions from an experiment? No, most decidedly not. When the data have been statistically analyzed and certain measures together with their errors have been derived, the investigator's work has just begun. Most any reasonably intelligent clerk can perform the necessary arithmetical processes involved and deliver to you a statement that the mean difference and its standard error are 4 ± 2, but it is then your job to determine what that difference signifies. Statistical methods will measure the difference that exists and provide an estimate of its mathematical significance but no mathematical process yet devised will tell you *why* that difference occurred. That particular difference might be due to the effect you are trying to measure but equally often it may be due to something else. No statistical method will take the place of common sense and good judgment.

Do not become overly enthusiastic because it so happened that a particular difference is highly significant mathematically speaking. It may well be that the difference is of no practical importance. Mathematical significance and economic significance do not necessarily coincide. There are instances when an insignificant difference may be of extreme importance for certain conditions. Such a seeming paradox is brought about by the inability or impracticability of sampling a sufficiently great number of seasons and locations for every treatment concerned.

No one should attempt to interpret the results from an experiment depending entirely on the statistical information therefrom. The quicker come-up of the plants, the increased vigor of early growth, and the greater rapidity of growth, any one of these or other responses may be of sufficient economic value to warrant the recommendation of the new treatment even though the yield figures may not be made to show odds of exactly 19:1. To have seen the response, yes the daily response, of the plants to their environment is to have learned much that figures could never convey.

In conclusion it would be well to reiterate a few statements. The time to analyze the data is before the data have been obtained; in other words, it is most essential to fit the experimental plan to some method or methods of analysis rather than to try to find some method that may be applicable to the data after the experiment has been concluded. Do not exhaust yourself with the statistical phase of the experiment for after the most exacting statistical analysis the investigator's work has merely started. The interpretation of the observational data should be coordinated with such statistical measures as have been acquired in order to furnish a sound basis for judgment as to the merits of a particular treatment. Conclusions from most experiments must be tempered definitely or by implication with the knowledge that the facts discovered hold only for that experiment under those particular conditions. Only so far as the sample of varieties, of treatments, of seasons, or whatnot, in the experiment are truly representative samples of their particular universe may the conclusions become generally applicable.

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CULTURAL AND MARKETING PROBLEMS*

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As in preceding years, the report of the Research Committee has been subdivided according to subject matter. These subdivisions and leaders thereof are as follows: (1) Virous diseases--Donald Folsom; (2) Plant Breeding and Selection—C. F. Clark; (3) Fungous Diseases—E. S. Schultz and W. P. Raleigh; (4) Cultural and Marketing Problems—William Stuart.

The writer has not found it convenient to review all of the 1934 literature but has included a number of papers in the bibliography accompanying the report.

The 1934 publications by our agricultural experiment stations dealing with potatoes are noticeably few, and for the most part deal with local rather than general problems. For example, Garcia and Young's (14) bulletin reports results of a six years study of potato growing in the Bluewater, N. M., irrigation district in which irrigation and soil texture conditions in relation to yield were noted. Kimbrough and Costa (20) reported results of a study of the effect of size of seed piece on recovery of plants from frost injury.

Five sizes of sets were used, as follows: ½, ¾, 1, 1½ and 2 ounces. The 1½ ounce set was found more satisfactory from the standpoint of plant recovery than the smaller sets. Samples of sets were dug up at stated intervals from time of planting to determine rate of starch consumption by young plants. It was found that at time of plant emergence from ½ to ⅔ of the starch had been consumed.

Some interesting data on potato growing with tractor power are presented by Clyde and Blasingame (9). The publication is unusually well illustrated. According to the authors the objective

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sought was that of determining the relative reduction in cost of man and power labor through the use of tractor power. Such costs as rent, insurance, taxes, seed, commercial fertilizer, manure, spray materials, hauling and grading were not included, as they were not considered to have any relation to power costs of field operations. Operation costs as given in table 1, show man hour labor per acre to have averaged 16.15 hours; tractor power 11½ hours, and fuel oil 16.33 gallons.

The study of the economics of certified seed potato production in Vermont as reported by Hitchcock (17) was undertaken for the purpose of determining the conditions and methods of management which make for success and to appraise its possibilities. The data used are based on 359 potato enterprise records secured by the survey method, of which 119 were obtained in 1928; 127 in 1929; and 113 in 1930. According to these records it was found that the average cost of growing an acre of certified seed in 1928 was $158.00; $156.00 in 1929; and $171.00 in 1930. The average production in bushels for these years was 210, 245 and 310, respectively. These figures show an actual cost per bushel of 74, 63 and 54 cents. Cost items for labor, fertilizer, seed, power, spray materials, etc., are presented.

Aylesworth (3) in Michigan found from the records of 59 table stock growers and 39 certified seed potato growers that the average acre production cost of the former group was $32.53 and of the latter $66.94. The table stock growers averaged 101 bushels per acre, or an average cost per bushel of 32c.

On the other hand the 39 certified seed potato growers averaged 234 bushels per acre, or a cost of 29c per bushel. Further analysis of the table stock growers' data showed that the bushel cost of those producing less than 80 bushels per acre was 41c; from 80 to 125 bushels, 33c; and over 125 bushels, 25c. In the case of the certified seed growers, those producing under 200 bushels did so at a cost of 57c; from 200 to 300 bushels, 30c, and over 300 bushels, 23c.

Jehle and Heuberger (19) report results of a study of potato seed maintenance in Maryland. Continued efforts with the McCormick variety since 1928 have resulted in marked improvement in the quality of the seed stock. In 1931 similar improvement was undertaken with the Russet Rural and in 1933 tuber indexing was begun on the Dakota Red (Jersey Redskin), Spaulding Rose, Triumph, and Up-to-Date varities.

Hartman's (16) studies on the effects of storage temperature on the propagation value of potato tubers is an outstanding contribution

to our literature on this subject. According to the author the specific objects of the experiments involved were to determine more accurately the effects of storage temperature on:

1. The propagation value of potato tubers.
2. The character of the plant growth produced from the tubers which accounts for the differences in the propagation value.
3. Changes in the tubers in storage, giving rise to differences in plant growth developed from the tubers.

The data presented are worthy of careful study, especially the relation of storage temperature to time of emergence. On this aspect the author does not make it clear whether the tubers were immediately planted after removal from storage. This is a rather important point because we have found that if this is done the effect of storage temperature on plant emergence is quite marked. If on the other hand the tubers are removed and held at a temperature of 60° to 70°F for a week or so, thus allowing the low temperature storage tubers to warm up and become vegetatively active, there is little if any difference in germination. In other words, we have found that there is little, if any, depressing hold-over effect on the subsequent vegetative vigor of the seed, at least as between 32°, 36°, and 40°F storage.

Somewhat similar studies to those of Hartman are reported by Wright, Peacock and Whiteman (40) under the caption of "Effect on subsequent yields of storing cut seed potatoes at different temperatures and humidities." These investigations extended from 1926 to 1930, inclusive. The temperatures used in 1926 and 1927 were 32°, 40° and 50°F. In 1928, 1929 and 1930, the 32° storage was discontinued and 60° and 70° temperatures added. Three degrees of humidity were maintained, that are referred to as low, medium and high, approximating 70, 80 and 95 per cent saturation. Loss in weight at different temperatures and humidities are given, together with per cent of stand from cut seed subjected to different periods of storage at various temperatures. In 1926 and 1927 tests were conducted with Irish Cobbler, Triumph, Green Mountain and Russet Rural. In most cases, especially in 1927, the stands increased as the storage temperature increased from 32° to 50°F. A general increase in yield followed rise in storage temperature. In 1928, 1929 and 1930 studies were confined to the Irish Cobbler and Green Mountain. Maximum yields were obtained from the higher temperature storage seed in 1928 of the Irish Cobbler with no marked differences in the case of the Green Mountain. The same

point can be raised in regard to influence of storage temperature on time of emergence, that is, the stored seed was planted immediately after removal from storage.

Appel's (1) paper on vitality and vitality determination in seed potatoes discusses two rather recently evolved methods of estimating the vigor of, or freedom from disease infection of potato tubers. The first of these is the copper method of Bechhold and Erbe, which Appel considers very simple, but regards the evaluation of the results as more or less difficult. This method consists in inserting a strip of copper 1.5 cm. wide and 10 cm. long lengthwise of the tuber so that the ends protrude. The tuber is placed in a warm moist chamber which is then placed in a thermostat and held at 38°C. for 8 hours. The moist chamber is then taken out and held for 16 hours in a temperature of 18° to 20° C, after which the copper strip is removed and the tuber cut in two at right angles to the flat surface of the copper. On the cut surface along the channel made by the copper plate there appears a more or less intensely colored zone that at first is brownish red, which assumes upon exposure to the air a dark gray or black tone. Healthy tubers are more intensely colored than diseased ones. Intensity of color varies with varieties.

The second method is known as the Wartenberg and Hey's potentiometric method of evaluation of cropping values. The process followed involves the washing, peeling and grating to a mash the tubers to be tested. Apparently contact with metal utensils influences accuracy of determinations as a glass grater is used. The grated mash of each tuber is put in a beaker and mixed with double distilled water in the proportion of about 1 to 2. After the mash is stirred the froth is removed with a glass spoon, and a clean platinum electrode is inserted into the center of the settled mass in each glass. The above arrangement represents a half element since the platinum electrode receives an electrical charge from the mash. If a second half element, one with a known constant potential is taken, it is then possible to measure the difference of potential of the double half element and to calculate the electric charge which the platinum sheet has received in the potato mash, etc.

From time to time the claim is made that the potato serves as a host plant for an endotrophic mycorrhiza which is supposed to have a symbiotic relationship with its host. The latest claim to such a fungous relationship with the potato is found in a recent paper by Constantin, Magrou, Bouget and Jaudel (12) entitled "Production experimentale de mycorrhizes chez la pomme de terre." The authors cite Noel Bernard as having found mycorrhiza generally

absent in cultivated potatoes. On the other hand, it is claimed this fungus symbiont is found in some wild species, as for example Solanum maglia, in its native habitat in South America also on other species of the genus Solanum, such as S. verbascifolium and S. dulcamara. One of these was used to induce mycorrhiza development on S. tuberosum. This was done by sowing seed in a poor soil inoculated with soil from the base of a plant of S. dulcamara in which the presence of the endophyte had been noted. They claim that by a different procedure it was possible to obtain an analogous result. Seed of the French variety Marechal Franchet d'Esperey was sown May 14, 1933, at Bagneres-de-Bigorre at an altitude of 1400 meters in an unfertilized soil. The seedlings were allowed to grow to maturity and two were found that had their roots abundantly invaded by an endophyte having the same characteristic organisms of the mycorrhiza fungus. The authors claim that certain varieties are resistant while others are tolerant of it establishing a more or less complete symbiosis. Similar results were obtained at Verrieres-le-Buisson. Evidence was secured which indicated that mycorrhiza of Orobus tuberosus were not able to infect S. tuberosum.

Davidson's (13) paper entitled "History of Potato Varieties" furnishes interesting information relative to most of the earlier cultivated varieties of that region. The publication is chiefly of interest from an historical standpoint.

Nixon's (25) interesting paper on the "History of Potato Growing in Pennsylvania" is well worth reading. Due credit is given to the pioneer commercial potato growers and the successive stages of the development of the industry.

Those who bemoan the fact that the potato is unjustly maligned as a fat-producing food, should derive some comfort from the recent action taken by the American Medical Association (2) in which their stamp of approval was given to a combination meat and potato diet. The dictum put forth by faddists that proteins such as meat, and carbohydrates such as potatoes and sweets should not be eaten at the same time was called incorrect, dangerous and lacking in scientific justificaton. Experiments on hospital patients by Dr. Martin Rehfuss of Philadelphia have shown that even chronic invalids could properly digest the combination of meat and potatoes. The average time their stomachs required to digest a meal of hamburg steak alone was 3 hours, 51 minutes. With an equal amount of steak and mashed potato, 3

hours, 54 minutes, and with butter added to the potatoes it took 8 minutes longer.

Potato tuber discoloration was the subject of a paper by Tilford (35) in which he enumerated the various factors known to cause discoloration.

The use of clean branded bags in marketing potatoes, according to Littlefield (22), is more than justified by the extra price received. A comparison of the merits of cotton and burlap sacks indicated a decided preference for the former which showed a net price gain of 7 cents per cwt.

Some additional data in regard to the use of chemicals in shortening the rest period of the potato are presented by Stuart and Milstead (34). In the studies reported potatoes were treated with ethylene chlorhydrin either as a gas or by the dip-gas method. Treatments with sodium thiocyanate were either by the dip-gas or soak method. The principal contribution made by these studies is that of the reaction of different varieties to chemical treatment.

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THE PRICE SITUATION

The following report on potatoes was released on June 15 by the Bureau of Agricultural Economics of the United States Department of Agriculture:

Potato prices declined sharply during May, under the pressure of heavy marketings of both old and new stcok. Prices in all markets are now much lower than they were a month ago, but the supplies of potatoes available during the next two months indicate that some advance in new-stock quotations is in prospect. Production in the second-early States and the first section of intermediate States is indicated to be about 17 per cent below that of last year and 15 per cent below the recent five-year average.

The total 1935 commercial crop of early potatoes is estimated at 36,550,000 bushels, compared with 42,799,000 bushels in 1934 and the 5-year (1929-33) average of 37,893,000 bushels. Most of the crop produced in the early and second-early states has already been marketed, leaving only that in the two intermediate groups to go during the next 2 months. Production in the second-early states is estimated at 6,089,000 bushels this year, or 25 per cent less than in 1934, but 6 per cent above average. In the first section of the intermediate states, the commercial crop is forecast at 10,834,000 bushels, or 12 per cent below that of 1934 and 24 per cent below the 1929-33 average. Production in the second section of the intermediate states probably will total close to 7,600,000 bushels, or not much different from the 1934 crop. These indications point to somewhat less new potatoes available for market during the next few months than were available a year ago, which with slightly stronger demand conditions probably will result in somewhat higher prices than last year.

Although car-lot shipments of potatoes during recent weeks have averaged slightly less than those during the same period in 1934, it is probable that total marketings have been considerably heavier, owing to the larger volume moved by motor truck. During recent weeks, more old stock has moved by rail or boat than during the same period last year, but slightly less new stock. Shipments from the late states this season to June 8 totaled 156,390 cars, compared with 163,425 cars to the corresponding date last year and a season total for 1933-'34 of about 164,775 cars. About 17,170 cars of new potatoes have been shipped this year to June 8, as against 21,740 by the same time last spring. Shipments have been lighter this season than in 1934 in all of the early states. Shipments from North Carolina and Virginia are starting earlier than last year and, therefore, are greater.

Potato prices at central markets declined sharply during May from the relatively high levels reached in mid-April. Prices of old stock at New York dropped from 97 cents per 100 pounds sacked l.c.l the first week of May to 72 cents the first week of June. New stock declined sharply from $4.12 to $1.56 l.c.l basis. A year ago, old potatoes averaged $1.38 and new stock $1.59 in that market. At Chicago, old stock, mostly Round Whites from Wisconsin, averaged 67 cents per 100 pounds (car-lot basis) the last week of May, compared with 77 cents the first week of that month, whereas new potatoes brought $1.54, as against $2.60 the first week of May.

Shipping point prices followed much the same trend as city market prices during May. At Presque Isle, Maine, Green Mountains were quoted at 25½ cents per 100 pounds, f.o.b., during the first week of June, compared with 50 cents the first week of May, whereas Round Whites at Waupaca, Wisconsin, averaged about 40 cents, f.o.b. usual terms, sacked per 100 pounds, against 50 cents in early May. Shipments from North Carolina had just begun to move and prices the first week of June averaged around $1.20 per 100 pounds, or only a few cents higher than during the corresponding period last year. F.o.b. prices at Alabama and Louisiana shipping points declined from $1.65 to a little less than $1.00 per 100 pounds during May, but recovered slightly to $1.25 during the first week of June as the end of the season approached.

The United States farm price of potatoes averaged 44.6 cents per bushel on May 15, compared with 49.1 cents on April 15; 73.7 cents on May 15, 1934; and 69.4 cents the May average for 1910-1914.

SECTIONAL NOTES

ARKANSAS

Yields in the southern part of the state are reported good where stands were secured. Reports from the South Arkansas Truck Growers' Association, a federation in South Arkansas shipping under the Pine Cone brand, show that the association was receiving from $1.20 to $1.40 per hundred for cars f.o.b. the week of June 3. A few shipments began in the Arkansas River valley, Fort Smith area, the latter part of the week of June 3, but main shipments will not begin before the week of June 17. The wet weather has damaged the crop in this section and stands are reported poor, which will affect total output. (June 11)—J. H. Heckman.

CALIFORNIA

The marketing of the Shafter potatoes is in full swing and this district is shipping heavily. The probable total production for Kern County will be 7000 carloads. These potatoes, to be marketed efficiently, must be sold during June and July. In the past this district has marketed only from 3000 to 4000 cars, so the extra load this year is an undecided problem.

The potatoes in the Stockton District have experienced two heat waves which undoubtedly will have some effect on total yields; however, conditions in the next 60 days are the real determining factors. The probabilities are that the Stockton crop will be just about the same size as last year. (June 8)—H. G. ZUCKERMAN.

COLORADO

Potato planting in the Greeley district will not be completed until about the 20th of June. Nearly all other districts have about finished planting at this time. All potato districts of the state received from six to eight inches of precipitation during May, and water storage is nearly normal at the present time. Cold wet weather has delayed planting considerably in some districts. Very little of the crop has emerged at the present writing. Last year at this time psyllids were appearing in tomatoes and early planted potatoes. There has been no sign of this insect so far this year and it is possible that weather conditions are such that the damage will be comparatively light when it does appear. (June 8)—C. H. METZGER.

CONNECTICUT

It seems to be the concensus of opinion that somewhat more area is devoted to potatoes in Connecticut than in 1934. Most of the increase and also that of recent years has occurred in the Connecticut Valley. However, municipal gardens and livestock farmers also have increased acreages.

At this time, the largest plants are only about 6-8 inches high and therefore it is too early to estimate crop prospects. May was a cold, dry month, but a recent week of wet weather has made conditions favorable for a rapid growth of vines during the remainder of June. (June 11)—B. A. BROWN.

IDAHO

Just at this time it is difficult to determine what the Idaho potato situation will be this year. Our main crop is now being planted. I suspect that we will have a somewhat larger acreage than last year, although I doubt if it will go very much over 100,000 acres. Generally speaking, the prospect is good in that we have had favorable weather, and I believe that the various potato growing districts of the state will have sufficient irrigation water to carry their crop through. (June 8) —E. R. BENNETT.

INDIANA

The acreage of early potatoes is not so large as we anticipated, owing to the unfavorable weather at planting time. We have had a considerable amount of rain since planting. The condition of the potatoes that are up is very good. Very little or no damage from insects or diseases shows at this time. Most of our better growers are equipped to spray or dust as soon as any trouble appears. Some of the late potatoes are being planted and the rest will be planted between now and the 25th of July. The growers in the northern part of the state plant during June and those in the central and southern part of that state plant the latter part of June and until the middle of latter part of July.

Our growers are not very much in favor of the Warren Potato Bill that has a tendency to control the production of potatoes in Indiana since we are a deficient state. Most of the crop in this state will be either Cobblers or Rurals. (June 11)—W. B. WARD.

IOWA

The state legislature of Iowa passed, and the governor signed a bill, making it illegal to offer for sale or to sell seed potatoes which bear a blue tag, the word "certified," or any claims of freedom from internal disease, unless said seed has been certified by a state authority.

The full text of the act follows:

Section 1. "It is hereby established that the certification system is essential to a good seed potato supply for the state and that from long use by state authorities in states producing the great bulk of northern seed used in Iowa, blue tags attached to bags containing such certified seed have become identified in the minds of the public as evidence of official certification of such seed, and of the superior quality thereof.

Section 2. The sale of, the contracting for delivery, the exposure

for sale of seed potatoes or potatoes sold to be used for seed bearing a tag of either blue in color or prominently printed blue, or the word 'certified' or similar printed or written claim or about which any such verbal claim has been made, unless in truth such seed has been certified by duly constituted state authority, are hereby forbidden within the state of Iowa, except that

First crop grown from certified seed may bear a statement as follows: 'These seed potatoes are not certified but are the first crop grown from certified seed'; provided, however, that the words 'not certified', and 'certified' shall be in type of equal size and weight of face, equally displayed and close together, and that such statement if put upon a tag, shall be on a tag not blue in color nor prominently printed in blue. The statements permitted under this section are a violation of this act if false in fact.

Section 3. Any seed potatoes offered in violation of the terms of this act shall be confiscated and sold for the benefit of the school funds of this state. Any individual or the manager or agent of any firm or corporation violating the terms of this act shall be fined not less than ten (10) dollars nor more than one hundred (100) dollars. The sale of seed potatoes in violation of this act shall be judged grounds for civil damage of fifty (50) cents per hundred pounds due the buyer from the seller, his salesman, agent or manager, the said fifty (50) cents per hundred damage to be over and above any reduction in crop shown to have been sustained by the use of seed misrepresented to the buyer.

Section 4. It shall be the duty of the secretary of agriculture and his agents to enforce this act and of the county attorneys and of the attorney general of the state to cooperate with him in the enforcement of this act. The secretary of agriculture is empowered and directed to prescribe the color, form and wording of tags and labels used on seed potatoes.

Section 5. This act being deemed of immediate importance shall be in force and effect from and after its passage and publication in the Northwood Anchor, a newspaper published at Northwood, Iowa, and the Lake Mills Graphic, a newspaper published at Lake Mills, Iowa."

Contrary to the spring of 1934 which was early and warm and dry, the spring of 1935 in Iowa has been cold and there has been an abundance of moisture. The acreage probably is fully average, perhaps a little above average. No potatoes have been planted, however, because of other crops blowing out and this will make a little difference

in the final result. Conditions on the great marsh at Hollandale, Minnesota are very much the same as above reported for Iowa.

Not many growers have taken an active enough part in the fight for farm equality to get warmed up much to the support of the Warren Bill in Congress. · The Iowa State Vegetable Growers' Association as yet has taken no official action on this bill. The two members of Iowa on the committee in agriculture in the House of Representatives at Washington are understood to be opposed to the bill. A few thoughtful growers believe that the enforcement of the bill will be so extremely difficult as to be impractical. (June 10)—C. L. FITCH.

KANSAS

The Kaw Valley potato district received an overabundance of rainfall during May and the first half of June. Low fields at various points along the overflowing Kansas river were flooded and it is estimated that approximately 25 per cent to 30 per cent of the 11,000 acres of potatoes in the Kaw Valley were destroyed.

Cool temperatures have prevailed and good yields are in prospect from fields that were not injured by standing water.

This season has been cool with an overabundance of moisture and is directly opposite that of the season of 1934, which was very hot and dry. (June 12)—O. H. ELMER.

KENTUCKY

Because of a late wet season, potatoes were planted later than in the last 15 years, some of them as much as a month after April 10, which we consider our deadline. The continuous wet weather has made development of the crop slow. It looks good, however. Possibly 5 per cent of the seed intended for planting the early crop was put in cold storage, to be used in July. Kentucky-grown certified seed moved well, possibly 5 per cent short of expectation. It is believed that with the early crop being so handicapped, a ready market will appear for seed planted as second crop. (June 8)—JOHN S. GARDNER.

LOUISIANA

We produced an excellent crop of potatoes this year. The price was very good for the first half of the shipping season but, as usual, was not so good during the latter half. Most of the growers are in better financial condition than they were last year. (June 6)—JULIAN C. MILLER.

MAINE

There seems to be no end to the volume of potatoes remaining in this State. Shipments continue above one hundred cars daily, realizing to the grower or shipper approximately starch factory prices. Starch factories are crowded with long lines of waiting teams and trucks day after day. Much of the available supplies are deteriorating rapidly through sprouting and softening. Thousands of barrels will be dumped in the fields before the season is finally closed.

The new crop has been making excellent progress. The weather has been very favorable until this past week when it rained for four days, with consequent washing and gullying of the fields. Undoubtedly much leaching of the fertilizer accompanied this erosion.

Grain and timothy hay are making excellent progress, but the stand of clover is decidedly inferior to that of last season. This is largely to be accounted for by lack of money to purchase lime during the past two years.

Maine Potato Growers, Inc., the cooperative marketing association, is closing a successful year from the standpoint of comparative returns to members, and service rendered. They are looking forward to increased tonnage this next season. (June 13)—FRANK W. HUSSEY.

The new branding law which goes into effect July 5th means that from now on shippers of Maine seed potatoes must mark their potatoes as they really are. This includes bulk shipments, truck shipments and regular carload lots, such as is generally handled. The true quality of the potatoes in each container will be stated in simple terms on the container. The basis for these terms are the national standards set up by the U. S. Department of Agriculture. There is no intention on the part of anyone to discourage the use of private brands because these have their place. The law does, however, provide certain markings that must be made by four definite statements on each container: (1) the name of the product; (2) the grade—whether U. S. Fancy, U. S. No. 1, U. S. Commercial, or U. S. No. 2, as the case may be; (3) the name and address of the person or persons responsible for grading, and (4) the true net weight. The markings must either be printed on the sack or upon durable tags attached to each container. There is no provision for shipping potatoes ungraded, nor is there any provision for shipping culls or pick-outs. They must be graded and must be marked as is. This act also applies to potatoes from other States offered for sale in Maine.

The only exemptions are certified seed in containers, to which

the official State of Maine Blue Tag has been attached. Growers may sell their potatoes within the State, however, in bulk, which provides for the hauling to the shippers and dealers. Just as soon as they are packed for sale, they must be marked. There is a penalty attached which provides a fine for violation of the act. The Department feels that this True Branding Law will result in the shipment of better grade of stock from the State than has ever been shipped before. Our growers and dealers are behind the movement solidly which will make it an easy law to enforce.

An appropriation of $8,000 was made by the Legislature for the purpose of carrying out the provisions of this act, and it will be done under the direction of the Division of Markets.

All planting was finished the week beginning June 3rd. It is too early to make any prediction as to a crop. It is doubtful if there was any cut in acreage over last year. There is no price for old stock worth mentioning, in fact it doesn't pay to touch them at all.

Applications are being received daily for this year's field inspection. The number of acres entered cannot be given for about another week.

Figures just compiled in this office show that Maine shipped 2,837,670 bushels under the blue tag last season and we plan to raise enough to supply any demand that the trade may make upon us. (June 14)—E. L. Newdick.

MASSACHUSETTS

Weather conditions have been favorable for the potato crop. While the official acreage report is not yet published indications point to approximately the same acreage as last year.

Considerable rhizoctonia injury of young shoots has been noted in the various plantings inspected. Flea beetles are also much in evidence. With most of the earlier-planted potatoes now 4 to 5 inches in height, growers are planning their first spray operations this present week. Recent rains following a spell of dry weather should provide ideal growing conditions for the crop (June 10)—Ralph W. Donaldson.

NEBRASKA

Owing to abundant rainfall in Western Nebraska prospects for a large potato crop in the dry land seed-producing region near Alliance are very good. A large acreage has been planted to early potatoes in

the North Platte Valley and a still larger acreage is now being planted to the late crop. Common seed is selling for $1.50 a cwt. and certified for $2.00 a cwt. (June 10)—LIONEL HARRIS.

In the southern and eastern part of Nebraska many potatoes were planted unusually early, that is—before the first of April. In spite of this fact the early crop is probably less advanced than usual because of the very cold cloudy weather in May,—rain almost every day for twenty or more consecutive days. Because of this large amount of moisture, the summer garden crop is likely to be earlier than usual. This will have an effect on the early fall market—but that will probably be counterbalanced in a degree by the destruction of the potato crop by the devastating flood in the Republican Valley, where a considerable acreage of potatoes is grown.

In the western part of the state, in the irrigated districts, there seems to be an unusually large acreage of very early plantings; i.e. late April and early May. This is a result of the relatively high prices received and also because of the reduction in sugar beet acreage. The regular or late commercial or seed plantings in the irrigated regions got under way with great rapidity about June 7. Seed is being planted in ground that has an abundance of moisture and as the seed has kept very well and is in excellent physical condition, stands will probably be excellent. The acreage in the irrigated regions will be above normal—how much so, is difficult to determine at this date.

In the dry land regions of western Nebraska planting is not yet under way. Field operations have been at a standstill because of prolonged rainy weather. Throughout most of the district there have been 10 to 12 inches of rain since March 10. Most of this rain soaked in. The average annual rainfall in this region is 15 to 18 inches. Planting will get under way this week (June 10th). The dry land acreage will be below normal because of the seed shortage resulting from the crop failure during the 1934 drought, but crop production prospects have seldom been better at this early date. (June 10)—H. O. WERNER.

NEW JERSEY

The crop was late in getting started due to cool, dry weather. In the past ten days, however, the growth has been very rapid and, in general, the plants are about as large as normal. The stand is good for the most part. The chief exceptions to this are in those cases

where the sprouts have been injured by rhizoctonia. This trouble is most prevalent on light soil, particularly on gravelly knolls. Present prospects are for a good crop. The local potato dealers hope to operate from two offices again this year; one at Hightstown and the other at Freehold. As in previous years, only one price will be quoted by all dealers in these two offices. The Atlantic Commission Company has opened an office at Hightstown and plans to buy directly from the grower. (June 13)—Wm. H. Martin.

NEW YORK

The potato acreage of New York was less than one-half planted on June 1. Prior to this date growers found it too dry to properly prepare their soil. Exceptionally low farm prices of potatoes this spring have discouraged many of the smaller growers who will probably reduce their acreage. Our larger growers will probably plant a normal acreage; these men feel that the time to plant is when the seed is cheap. They also appreciate the importance of growing a fairly constant annual acreage as well as the fact that the long-time outlook for potatoes is good.

The writer inspected the acreage on 17 farms in Suffolk County, Long Island, on May 24 and 25. Growers on Long Island were somewhat concerned about the poor come-up. An examination of the misses in each field showed that the cause of the slow come-up was, in most cases, low temperatures since planting. Planter skips and rhizoctonia injury represent a very small fraction of the cause of poor stands. Most Long Island growers are distributing their fertilizer in bands on either side the seed piece with a minimum of fertilizer injury resulting.

Farm prices of potatoes have shown no improvement over the extreme lows experienced late in the winter. Western New York farm prices ranged from 10 to 12 cents a bushel on June 1. There seems to be no prospect of price improvement for the balance of the stored crop. (June 5)—E. V. Hardenburg.

RHODE ISLAND

The potato acreage will be about the same as last year. The season has been a little retarded due to low temperatures; otherwise, the crop is coming along in good shape. (June 12)—T. E. Odland.

NORTH CAROLINA

Part of the early potato section of North Carolina has had dry weather during May and the yields will not be very high in those areas. However, other areas have had sufficient rain and the yields are very good. The crop as a whole will probably not be so large as last year, but it is several days earlier. Prices are approximately $2.00 per stave barrel f.o.b. shipping point in carlots. The shipping season is much further advanced this year than last. (June 13)—ROBERT SCHMIDT.

SOUTH CAROLINA

The potato shipping season was practically completed on June 1, with growers receiving on an average of from $1.75 to $1.85 per barrel for the season.

The acreage was much smaller than had been first estimated, finally being placed at approximately 7,500 acres, as compared to 12,500 acres in 1934. The total shipments this year were approximately 1,900 cars as compared with 3,500 in 1934. (June 8)—GEO. E. PRINCE.

TENNESSEE

The crop is late this year. There was little or no digging the first week of June but many of the fields will be dug by June 15. Others, because of delayed planting due to wet weather, will not be ready to dig for some time yet. (June 7)—BROOKS D. DRAIN.

VERMONT

Disappointing as was the seed potato deal for 1934-'35, a very large part of Vermont stock from certified fields found a market as seed. Comparative figures have not been compiled, but it appears probable that less was sold for table stock than was the case last year.

Prices for certified seed ranged from a low of 32c per bushel, f.o.b. to as high as 75c for small lots. A considerable number of carloads went at 35½c per bushel f.o.b. when general quotations for table-stock would net 21c.

Some large lots of cobblers went to New Jersey and some carloads of Mountains to Long Island, but much Vermont seed was sold in Connecticut and Massachusetts. This is in line with what appears to be a growing trend. Accessibility by truck probably is one answer.

It is difficult to predict with certainty the acreage which will be entered for certification. About 100 samples have been planted in the Central Test Plot at the State School of Agriculture in Randolph Center but actual enrollments will not be made until July.

A reduction in local sales—the 5 or 10 bushel lots to general farmers and village gardeners—has been generally reported by seed growers. This would seem to indicate a smaller total acreage of potatoes in Vermont than has been predicted.

A number of Vermont growers in the Greensboro area are trying Spaulding Rose in a small way. This variety has never been grown to any extent in Vermont, but a large buyer in Connecticut has encouraged their growth here and believes he can handle considerable Vermont seed of that variety. (June 8)—HAROLD L. BAILEY.

VIRGINIA

The potato harvest has begun in the southernmost portion of the Eastern Shore. The first movement occurred approximately June 6th, with the growers digging very slowly. Harvesting, apparently, will not be heavy until the week of June 17th. From that time on there should be a liberal movement.

With a considerable acreage reduction, the farmers of the Eastern Shore will follow a leisurely harvesting course in the immediate future, unless weather conditions are such that they are compelled to move the potatoes rapidly.

The tonnage from the Eastern Shore should vary any where from 10,500 to 12,500 cars. Recent rainfall has thoroughly wet the soil over most parts of the Eastern Shore, making very favorable moisture conditions, with the exception of the southernmost part of the Peninsula. The crop conditions at this time are favorable, but there is no expectation of an outstanding yield. The quality is good.

The demand is reasonably good, since a wide area is buying from the Eastern Shore. New England, however, is not showing any great enthusiasm due to the prevalence of old potatoes on its markets. The prices have been ranging from $2.25 to $2.50, f.o.b. Eastern Shore points.

The lateness of the crops in Pennsylvania, Ohio, Illinois, Indiana and farther West should give a more favorable opportunity for the marketing of Virginia and Oklahoma potatoes, unless the expectancy of good prices may cause all these areas to hold back stock until the more northern territories start to market. (June 11)—G. S. RALSTON.

WASHINGTON

The strike on the Pacific Coast was apparently responsible for a sudden drop in the price of potatoes immediately following its beginning and the low price has been maintained since. This situation also stopped active movement of seed potatoes which indicates a probably lighter planting than would have been the case if potatoes had remained on the up-grade. At the present time old potatoes are retailing at approximately $22.00 per ton and new potatoes are retailing at about $40.00 per ton.

Apparently we are not going to entirely clean up our seed stock of the late varieties as a result of our present situation. This undoubtedly will affect the planting of certified seed which is now well under way.

The weather has been extremely dry for the past six weeks although the Coast areas experienced a fairly good rain over the week end. (June 11)—CHAS. D. GAINES.

WISCONSIN

Potato planting has been, in large part, completed in the northern half of the state. In the central belt, where the Rural New Yorker is grown chiefly for a late main crop, growers are still planting but the bulk of the crop will be planted by June 15.

Planting conditions continue favorable. Weather conditions have been very cool. In most places moisture is adequate. I would say therefore that early potato crop conditions in Wisconsin are satisfactory. Prices are dull and the unsatisfactory price conditions generally reported over the country prevail also in this area. (June 10)—J. G. MILWARD.

CANADA

Potatoes for the early market have made exceptionally good growth. Limited supplies of new potatoes for mixed car lots were available in British Columbia on June 6th, and digging will begin in Southern Ontario about June 26 and in commercial quantity, July 1st. The planting of late potatoes is now general, with a reduced acreage in most districts. Growers, however, are taking extra care with seed selection and treatment.

The acreage grown for certified seed will not be definitely known

until after July 1st, but a reduction of 25 per cent from last year's acreage is anticipated, mostly in Irish Cobblers and Green Mountains.

There are liberal supplies of old potatoes in all the principal markets; demand moderate to dull at 40 to 50 cents per 90 lb. bag, wholesale. Imported North Carolina Cobblers, supplies liberal, demand moderate at $5.00 to $5.50 per barrel for No. 1. (June 10)—JOHN TUCKER.

POTATO MEETINGS

July 6—Marietta, Ohio. Field Day, Washington County Truck Crop Station.

July 13—McGuffey, Ohio. Field Day, Truck Crops Experiment Farm.

July 20—Mount Vernon, Washington. Potato Field Day.

July 26—Amherst, Mass. Potato Field Day. Massachusetts State College.

July 31—Morristown, Penna. Montgomery County Potato Field Day.

August 8—Camillus, New York. Empire State Potato Club Field Day.

August 15—Wooster, Ohio. Potato Day, Experiment Station, Wooster, Ohio.

August 15—Avon, Colorado. Farmers' Field Day, Mountain Vegetable Sub-station.

October 21—Wausaukee, Wisconsin. Annual Meeting and Show, Wisconsin Potato Growers' Association.

November 5-8—North Judson, Indiana. Sixth Annual Truck Crops Show.

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AN INTERESTING EXPERIMENT

The early potato sections have had a disastrous season; Florida and South Carolina growers sold their crop for the lowest prices ever received. In North Carolina a fair price was maintained for some time but it finally broke to as low as $1.20 a barrel. In Virginia, potatoes returned the growers little more than a dollar a barrel on June 26. Made desperate by the low prices, a committee of Virginia growers agreed that no seconds or culls should be shipped; price cutting was to be eliminated and the base price raised to $2.10 a barrel. On July 15th the $2.10 price is being maintained and the growers are determined not to sell for less. Movement is slow, however, and approximately half the crop remains to be sold.

Will it be possible to maintain this price when New Jersey and other competing areas start digging? It would be desirable if these areas would delay moving their crop until Virginia is finished. Unfortunately, New Jersey cannot delay harvesting unless Long Island, the Connecticut Valley, Maine and other areas do likewise. It would be extremely difficult, if not impossible, to accomplish this.

It must be appreciated that the present low prices have prevailed despite the fact that the Virginia growers reduced their acreage approximately 25 per cent. Normally, this could be expected to result in larger returns. Unfortunately, however, the northern growers continued to sell old potatoes for less than hauling charges; in Maine, potatoes were sold for as low as 10 cents a barrel. It is apparent that little cooperation can be expected between various sections on a voluntary basis. This demonstrates the fact that if the potato situation is to be improved, it must be done on a nation-wide basis.

The Virginia growers are in a difficult situation and are doing what they can to correct it. Working alone, however, they are not likely to attain their full objective. The present situation does not permit the producer to obtain a living wage as the fruit of his labor. It would seem that the time is ripe to change this haphazard method of growing and marketing one of our most staple foods.